

Appl. No. : 10/715,320
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AMENDMENTS TO THE CLAIMS

1. (Currently amended) A method for adjusting valve timing based on the existence of a pre-ignition vibration within an engine being controlled by an electronic control unit comprising a control module that is in electrical communication with a vibration sensor, the electronic control unit being adapted to control an ignition timing of an ignition source and to control a valve operation, the method comprising:

sensing a vibration from a pre-ignition within the engine and determining when the vibration exceeds a first predetermined vibration value;

adjusting the ignition timing to a predetermined first value until the vibration is reduced to a vibration value below the first predetermined value; and,

adjusting the valve operation following the adjustment of the ignition timing to maintain the vibration value at a value below the first predetermined value.

2. (Original) The method of Claim 1, wherein adjusting the ignition timing comprises retarding the ignition timing, the method additionally comprising advancing the ignition timing in conjunction with adjusting the valve operation to maintain the vibration value at a value below the first predetermined value.

3. (Original) The method of Claim 1, wherein adjusting the ignition timing comprises retarding the ignition timing to a first predetermined ignition timing value when the sensed vibration exceeds the first predetermined vibration value.

4. (Original) The method of Claim 3, additionally comprising determining whether the vibration value has settled to a second predetermined value below the first predetermined value before advancing the ignition timing.

5. (Original) The method of Claim 4, wherein adjusting the valve operation comprises adjusting the timing of the valve to reduce an amount of air combusted within the engine after the vibration value has settled to the second predetermined value.

6. (Original) The method of Claim 5, additionally comprising advancing the ignition timing after the timing of the valve has been adjusted.

7. (Currently amended) An internal combustion engine comprising:
an engine body;

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a movable member movable relative to the engine body, the engine body and the movable member together defining a combustion chamber, the engine body defining intake and exhaust ports communicating with the combustion chamber;

an air induction system communicating with the combustion chamber through the intake port;

an exhaust system communicating with the combustion chamber through the exhaust port;

an intake valve arranged to move between an open position and a closed position;

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an exhaust valve arranged to move between an open position and a closed position;

a camshaft configured to actuate at least the intake valve;

an ignition system configured to ignite a mixture of fuel and air in the combustion chamber;

a pre-ignition sensor configured to sense a pre-ignition in the combustion chamber;

a change mechanism arranged to change an angular position of the camshaft; and

a control system configured to adjust timing of the ignition system and to control the change mechanism to change the angular position of the camshaft according to a sensed pre-ignition following retardation of ignition timing.

8. (Original) The engine as set forth in Claim 7, wherein the control system is configured to retard the ignition timing according to a sensed pre-ignition until the pre-ignition is reduced to a first value.

9. (Original). The engine as set forth in Claim 7, wherein the control system is configured to begin to change the angular position of the camshaft to reduce an amount of air flowing through the induction system after the ignition timing has been retarded.

10. (Original) The engine as set forth in Claim 7, wherein the control system is configured to advance the ignition timing while the angular position of the camshaft is adjusted.

11. (Currently amended) An internal combustion engine comprising:
an engine body;

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a movable member movable relative to the engine body, the engine body and the movable member together defining a combustion chamber;

a controller configured to control an ignition timing of an ignition source and to control a valve operation to reduce an amount of air delivered into the combustion chamber following retardation of ignition timing; and

means for sensing a vibration from a pre-ignition and determining when the vibration exceeds a predetermined vibration level;

means for retarding the ignition timing to a predetermined value to reduce the vibration;

means for adjusting the valve operation to reduce a quantity of air flowing into the engine body when the vibration exceeds the predetermined level; and

means for advancing the ignition timing when the valve operation is adjusted to reduce the quantity of air.

12. (Original) The internal combustion engine of Claim 11 additionally comprising means for determining when the vibration level settles below a predetermined vibration level, wherein the means for adjusting the valve operation waits until the vibration level settles below the predetermined vibration level before reducing the quantity of air.